



RESEARCH MEMORANDUM

PRESSURE DISTRIBUTIONS ON TRIANGULAR AND RECTANGULAR

WINGS TO HIGH ANGLES OF ATTACK -

MACH NUMBERS 1.45 AND 1.97

By George E. Kaattari

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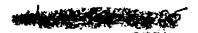
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NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

WASHINGTON

June 25, 1954









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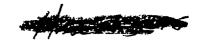
SUMMARY

In order to provide detailed wing-load-distribution data to high angles of attack, semispan pressure-distribution models of triangular and rectangular plan forms were tested at Mach number 1.45 within the angle-of-attack range of 0° to 30° and at Mach number 1.97 within the angle-of-attack range of 0° to 50°. The tests were made at Reynolds numbers of 0.26×10° per inch and 0.44×10° per inch for both Mach numbers.

Data were obtained on five models. The three basic models were two triangular wings of aspect ratios 2 and 4 and one rectangular wing of aspect ratio 2, all having thickened root sections, a structural feature generally required for supersonic all-movable wings. To evaluate the possible aerodynamic penalty of thickening the root sections, two other aspect-ratio-2 models, identical to two of the basic models but without thickened root sections, were provided.

In all cases the wings showed a tendency toward uniform loading at high angles of attack. Thus, as the angle of attack was increased, the center of pressure moved toward the centroid of area or, in terms of spanwise location, the center of pressure moved outboard for the rectangular wings and inboard for the triangular wings. The presence of thickened root sections on the wings had little effect on the centers of pressure and normal-force coefficients. Reynolds number effects were negligible in the range tested except for a small reduction in normal force in the case of the rectangular wing with thickened root at M = 1.97 as the Reynolds number was reduced from 1.76×10^6 to 1.04×10^6 .





INTRODUCTION

Since wings and controls for supersonic interceptor aircraft maneuvering at high altitudes are required to operate over a wide range of angles of attack, information is required on wing load distribution at large as well as small angles of attack. Unfortunately, available theory on the aerodynamic behavior of wing and wing-body configurations at supersonic speeds is restricted to cases where the angle of attack is small. Detailed pressure-distribution data on wing-body components available in the literature (e.g., refs. 1 to 3) are also generally limited to small angles of attack. Little data are available for high angles of attack at supersonic speeds, particularly for wing-body models with variable-incidence wings. In an effort to provide data for high angles of attack, a program has been initiated to measure pressure distribution through a wide range of angles of attack, both on wing-body combinations and on the components (wing and body). It is hoped that the data obtained will not only provide needed design information, but will also point the way for development of theories applicable over a wide range of angles of attack.

The present report presents pressure-distribution data to high angles of attack for several wings at two supersonic Mach numbers. The following data are presented: (1) tabulated pressure coefficients, (2) span-load-distribution curves for each angle of attack, (3) curves of normal force as a function of angle of attack, and (4) curves of center-of-pressure position as a function of angle of attack.

NOTATION

A wing aspect ratio

 C_{m} pitching-moment coefficient, $\frac{C_{N}(x_{h}-\bar{x})}{\bar{c}}$

 $C_{
m N}$ normal-force coefficient, $rac{
m N}{
m qS}$

c local chord, in.

cn local normal-force coefficient

cr root chord, in.

 $\frac{1}{c}$ mean aerodynamic chord, $\frac{\int_0^s c^2 dy}{\int_0^s c dy}$, in.





- ccn span loading coefficient, in.
- M free-stream Mach number
- N normal force, lb
- P pressure coefficient, $\frac{p p_0}{q}$
- p orifice static pressure, lb/sq in.
- p free-stream static pressure, lb/sq in.
- pw reference static pressure, lb/sq in.
- q free-stream dynamic pressure, lb/sq in.
- R Reynolds number, per in.
- s wing semispan, in.
- S wing area, in.²
- W wing (Subscript denotes model.)
- x chordwise distance from leading edge at spanwise distance y, in.
- xh distance from leading edge to hinge line along root chord, in.
- x distance from leading edge to wing center of pressure along root chord, in.
- y spanwise distance from root chord, in.
- $\frac{1}{y}$ distance from root chord to wing center of pressure, in.
- α angle of attack, deg

APPARATUS

Wind Tunnel

The investigation was conducted in the Ames 1- by 3-foot supersonic wind tunnel No. 1. This single-return, continuous operation, variable-pressure wind tunnel has a Mach number range of 1.2 to 2.5. The Mach number is changed by varying the contour of flexible plates which comprise the top and bottom walls of the tunnel.

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Models

Semispan models consisting of three triangular wings and two rectangular wings were constructed of hardened steel. A sketch identifying the models and a tabulation of their dimensions are presented in figure 1. Two triangular wings (aspect ratios 2 and 4) and one rectangular wing (aspect ratio 2) incorporated thickened root sections faired to integral hinge shaft extensions, since such thickening is generally required for supersonic all-movable wings to maintain structural integrity between the comparatively thin wing and a large hinge shaft. In order to assess the aerodynamic penalty of thickening the root sections, two of these wings, one triangular and one rectangular both of aspect ratio 2, were duplicated in plan form but had unthickened root sections and were provided with integral mounting flanges at their root chords. All wing sections in vertical streamwise planes were modified biconvex with maximum thickness ratios of 5 percent at midchord and with 50-percent-blunt trailing edges. Tubing was soldered into milled grooves on one surface of the wings and orifice holes were drilled from the opposite surface to communicate with the tubes at locations listed in table I in terms of spanwise and chordwise positions, y/s and x/c.

The wings were mounted on a boundary-layer plate serving both as a flow reflection plane and as a means of placing the wings in a region free of the tunnel-wall boundary layer. The thickened root wings were supported by their hinge shafts which fitted through a bearing in the boundary-layer plate. A clearance gap of 0.005 to 0.009 inch was allowed between these models and the boundary-layer plate to permit free rotation. The unthickened root wings were mounted on a turntable in the boundary-layer plate.

TESTS AND PROCEDURE

Range of Test Variables

All models were tested at Mach numbers of 1.45 and 1.97. The angle-of-attack range varied, depending on the Mach number and model, due to model structural limitations and manometer-board capacity. The largest angle-of-attack range of 0° to 50° was possible with model W_1 at Mach number 1.97. The smallest angle-of-attack range of 0° to 15° was obtained for model W_3 at Mach number 1.45. In order to determine the effects of Reynolds number, the models were tested at R = $0.26 \times 10^{\circ}$ per inch and $0.44 \times 10^{\circ}$ per inch with some additional data taken at R = $0.62 \times 10^{\circ}$ per inch for model W_5 at Mach number 1.45.





Reduction of Data

The local pressures were reduced to the pressure coefficient P as shown by the following expression:

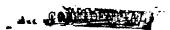
$$P = \frac{p - p_0}{q} = \frac{p - p_w}{q} + \frac{p_w - p_0}{q}$$

where the term $(p - p_w)/q$ is calculated directly from the test data and $(p_w - p_o)/q$ is obtained from a calibration of the wind-tunnel air stream. Calibration of the air stream indicated that the value of $(p_w - p_o)/q$ at M = 1.45 was essentially 0, but that at M = 1.97 it was approximately 0.02.

Chordwise pressure distributions were integrated for each span station by a tabular method to give local span loading coefficient ccn and local center of pressure $\bar{\mathbf{x}}/\mathbf{c}$. The absence of orifices at the leading and trailing edges of the wings required extrapolations of the pressure distribution to these points. Linear extrapolations were used, based, respectively, on the pressures measured at the first two and last two orifices of each span station. The spanwise load distributions were similarly integrated to give total load C_N and center-of-pressure location $\bar{\mathbf{x}}/c_r$ and $\bar{\mathbf{y}}/s$. The span loadings beyond the most outboard station of the models were approximated by assuming a parabolic load distribution tangent to the slope passing through the loading of the last two outboard stations and falling to zero at the tip.

Validity of Data

In considering the validity of the data two questions arise - first, what is the measuring accuracy and second, how well does the semispan-model data represent the data for a full-span model? From an examination of the inaccuracy in setting the model angle of attack, the variations from constant test conditions, and the ability to repeat the pressure data in reruns at $R = 0.44 \times 10^6$ per inch, it was concluded that errors in measuring the pressure coefficients were less than ± 0.02 at both Mach numbers for the semispan wings tested. Although the second question cannot be answered so quantitatively, there is evidence in the case of the rectangular wings that with but few exceptions the measured pressures represent the pressures on a full-span wing. For the rectangular wing with unthickened root, the measured pressure distribution at span station y/s = 0.025, which was in close proximity to the juncture of the root chord and boundary-layer plate, was in good accord with values predicted by shock-expansion theory at both Mach numbers for angles of attack below shock detachment. At larger angles, if two-dimensional flow persisted at



the inboard span stations of the wing, then any spanwise deviation in pressure distribution in this region would be an indication of viscous effects due to the presence of the boundary-layer plate. Therefore, in absence of suitable theory, the pressure distribution of station y/s = 0.025 nearest the juncture of the root chord and boundary-layer plate was compared with that of the adjacent station (y/s = 0.250) at angles of attack slightly above that for shock detachment. No significant spanwise deviation in pressure distribution was found except between the pressures measured at the leading orifices of the two spanwise stations, indicating a localized interaction between the detached shock wave and plate boundary layer. This was the only evident boundary-layer interference effect on this rectangular wing and had negligible influence on the integrated forces and centers of pressure. The data for the thickened root rectangular wing could not be analyzed in the foregoing manner since the flow near the root chord was affected by the presence of the thickened root section. Since no large effects of Reynolds number at the most inboard span station were noted at M = 1.45, it was concluded that the plate boundary layer had little effect at this Mach number; however, at M = 1.97, more extensive indications of boundary-layer interference were evidenced, as will be pointed out in the discussion of Reynolds number effects. The effect of the gap between the wing and the boundary-layer plate on the wing loading was believed negligible on the basis of the findings of reference 4 in which it is shown that small gaps do not affect lift forces.

RESULTS

Tabulations of pressure coefficients are presented for the models at M=1.45 and M=1.97 for $R=0.44\times10^6$ per inch in tables I(a) to I(j). The contributions to the loading and to center of pressure for each spanwise station are presented in tables II(a) to II(j) for both upper and lower wing surfaces. Summarized in tables II for each wing are also the normal-force coefficients, the center of pressure locations, and moment coefficients about the wing centroid of area. Figures 2 to 6 present plots of span loading coefficients, normal-force coefficients, and the center-of-pressure positions for each wing. Data taken at $R=0.26\times10^6$ per inch and 0.62×10^6 per inch are also shown on these plots for comparison.

DISCUSSION

Angle-of-Attack Effects

All the wings showed a tendency toward uniform loading at high angles of attack in the range tested. This was indicated by the fact that with increasing angle of attack the span loading curves tended to assume the shape of the wing plan form, and the center-of-pressure position moved toward the wing centroid of area.



Effect of Thickened Root

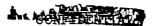
The effect of thickening the root can be seen by comparing figures 2 and 5 for the aspect-ratio-2 triangular wings and figures 4 and 6 for the rectangular wings. At M = 1.45, the span loading did not seem to be greatly affected by the presence of the thickened root for either wing. The center-of-pressure position was little affected for the triangular wing; however, the center of pressure of the thickened root rectangular wing was about 0.01c, forward of the center of pressure of the unthickened wing. At M = 1.97, for the angle-of-attack range below 17.5° (corresponding to shock detachment for the airfoil section), thickening the root section causes reductions in loading near the root chord such that the integrated normal-force coefficients were reduced by approximately 5 percent for both triangular and rectangular wings. At angles of attack above 17.50, the difference in loading became smaller (1 to 2 percent) for both wings. Again, the center-of-pressure position was little affected for the triangular wing while the thickened root rectangular wing showed a forward shift of O.Olcr in reference to that of the unthickened wing.

Effect of Reynolds Number

No large or systematic Reynolds number effects were noted except for the rectangular wing with thickened root at M = 1.97. For this case the pressure coefficients averaged 6 percent lower at R = 0.26×10⁶ per inch than the values at R = 0.44×10⁶ per inch over the angle-of-attack range tested. This difference was effective over the entire plan form and exceeded the possible error in measuring pressure coefficient throughout most of the angle-of-attack range. Pressure data for this wing tested on a larger boundary-layer plate at the same test conditions were compared with the present data in order to determine if this effect were due to the boundary layer on the plate. These results showed the same over-all Reynolds number effect but with slight variations at the most inboard station of the wing as compared with data taken on the smaller plate. It is surmised that the effect of Reynolds number was due to the combined effects of the thickened root and interaction between the strong leading-edge shock wave and the plate boundary layer.

Comparison with Force Data

As mentioned previously, the number of orifices were limited so chordwise and spanwise extrapolation of pressure distribution were required to obtain the integrated loads; hence, the accuracy of the



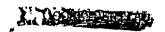
integrated loads is open to some question. A check of the accuracy was obtained at M=1.97 and $R=0.44\times10^{8}$ per inch from direct measurement of the normal forces on the thickened root wings with a strain-gage balance. These measurements showed an agreement within experimental accuracy with those found from the integrated pressure results of the present test (figs. 2(b) to 4(b)).

CONCLUSIONS

Semispan pressure-distribution models of two triangular wings of aspect ratios 2 and 4 and one rectangular wing of aspect ratio 2, all with thickened root sections, and a triangular and rectangular wing, both of aspect ratio 2 without thickened root sections, were tested at M = 1.45 at angles of attack from 0° to 30° and at M = 1.97 at angles of attack from 0° to 50° . These tests support the following conclusions:

- 1. All the wings showed a tendency toward uniform loading at high angles of attack. Thus, with increasing angle of attack, the center of pressure moved toward the centroid of area, and the span loading curves tended to assume the shape of the wing plan form.
- 2. At M = 1.45, thickening the root section had little effect on the span loading for both the triangular and rectangular wings. At M = 1.97, for the angle-of-attack range below 17.5° , the presence of the thickened root tended to reduce the span loading near the root chord, resulting in a loss of approximately 5 percent in the integrated normal-force coefficients for both triangular and rectangular wings. The loss became smaller (1 to 2 percent) for angles of attack above 17.5° . The center-of-pressure position was little affected by the presence of a thickened root for the triangular wing but caused a slight forward shift (about 1 percent of the chord) in the case of the rectangular wing.
- 3. At M = 1.97, a decreased normal-force coefficient (6 percent) was noted for the thickened root rectangular wing at the lower Reynolds number of 0.26×10^6 per inch as compared with the values at R = 0.44×10^6 per inch. This was the only case in which an appreciable or systematic effect of Reynolds number on normal-force coefficients occurred. The center-of-pressure position was negligibly affected for all wings in the range of Reynolds numbers at which the tests were conducted.

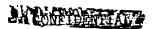
Ames Aeronautical Laboratory
National Advisory Committee for Aeronautics
Moffett Field, Calif., Apr. 19, 1954





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(b) Wing 1; M=1.97; R=0.44x10° per tech

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,	1870	教皇官皇官等 法等政策的复数	西京西京西京	秦城安安安安	90° -0.106 -,80° -,80° -,80° -,80° -,30° -,30° -,80° -,80° -,80°	10° -0.116 -3-17 -3-17 -3-17 -3-16	व विविद्यातिक विद्यम्पति व	6 455 - 055 - 055 - 055 - 175 - 175	100 0,090 0,071 000 000 000 000 000 000 000 000 000	0° 106 106 106 106 103 103 103 103 103	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	6° 299 209 209 209 209 209 209 209 209 209	10° 1 A00 0. 336 . 339 . 339 . 339 . 339 . 339 . 340 . 3	5 ⁹ 2 ⁷	715 0	590 1. 590 1. 1790 410 90. 100 90. 90. 90. 90. 90. 90. 90. 90. 90. 9	(80 mg/s) (80 mg/s) (80 mg/s) (80 mg/s) (80 mg/s)	ō.œ;	新聞的 新聞的 新聞	· · · · · · · · · · · · · · · · · · ·	0.468 -291 -297 -291 -201 -27		3 HE BENEVA	#5°	20 0 157 0 1	15° -0.064 097 309 391 199	-0.089 045 068 060 109 109	0.007 .004 -005 -005 -005 -006 -006 -006 -006 -006	3° 0.005 0.0	0° 000 000 000 000 000 000 000 000 000	1° .150 .150 .150 .066 .047 .006	6° 109 0 108 1179 1189 1199 1199 1199 1199 1199 1098 1099 1098 1099 1098 1099 1098 1099 1098 1099 1098 1099 1098 1099 1098 1098	300 200 200 200 200 200 200 200 200 200	190	200	650	· · · · · · · · · · · · · · · · · · ·	1.130 1 1.058 1 1.069 1 1.069 1 1.069 1 1.069 1	200 1. 161 1. 165 1. 166 1.

par mob	(7) Wing 3; 14-1.97; 74-0.44x10 ⁴ per inch

		(e)	Wing 3	; M-1	.45;	R-0,4	640°	par la	ot										(I) MI	9 S; M	⊢1.9 7	; X-O.	44×10	per) Danie								
		10	-	CLOS		Π	Low	7 145			_	_				Yn	-	Case									Love	r suri					
7/=	Z	150	700	6	30	04	5°	60	100	15°	7/4	X	+3°	1400	Β°	30°	520	90°	15°	10°	60	30	8	30	60	160	159	800	4	30°	350	Mg.	150
0,005		- 483 - 483	14838	88659	00.00	199	4 5 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	. 199 944.	建	6 8 8 5 5 B	0,025		0.200 5.313 3.315	-398 -313 -313	- 323	- Mil	- 107	- 185 - 807	- 12.25 - 12.50 - 17.50	0# 017 104	.006	::33	341568	889488	.036	0.78 9.86 9.75 9.75 9.75 9.75 9.75 9.75 9.75 9.75	37	經	125	1,300		99558	134 Pi
.500	が上海対域があるの	-,128	- 154 - 159 - 250 - 250 - 250 - 254 - 250	- 003 - 073 - 073 - 133 - 135 - 260	.050 .039 .045 .045 .058 .098 .189		3139 3139 3130 3130 3130 3130 3130 3130	357 439 115	.55 .57 .57 .07	10000000000000000000000000000000000000	.9 70	全等与基本等于	11111111111	30	- 497	870 865 865 300	- MT - MD - MD - MD - MT	-,916 -,996 -,999 -,915	11000000000000000000000000000000000000	- 095	588888	.001	36888888	1961	電影報報報本語記	医智慧规则的独立	电影技术 主要	BRESSER	F1122988	11188 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	1.733 1.464 1.306 1.306 1.003 .871 .809	11111111111111111111111111111111111111	1.80 1.90 1.95 1.05 1.05 1.09
-553	の以外の場合の	- 323 - 895 - 337 - 334 - 336 - 336 - 839	- 196 - 496 - 199 - 199 - 190	- 设	.004 030 079 098	168	.070	.165 .167 .117	207	1.63 63 6 5 6 5 5 6 5 5 6 5 5 6 5 5 6 5 5 6 5 5 6 5 6 5 5 6 5	.563	3月最高重点最低	- 313 - 313 - 313 - 310 - 310 - 310 - 310	- 314 - 315 - 319	- 57	- 35 - 35 - 35 - 35 - 35	269 269 269	- 814 - 840 - 840 - 840 - 940	- 150 - 150 - 150 - 150	66439333	- 655 - 656 - 669 - 689 - 73	38.39.343	388	25586588 2586588	8968BEG\$	高智慧性的	1188	350	1.261	1.00	1.333 1.335 1.198 1.000	83.56.23	1.666.14.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1
ATT)	成立教育を行うの	-150 -196 -399 -397	110	-:072	-,011 (40,-	-010	믮	, 海	.175 .186 .079	957 669 569 567 567 567 567 567 567 567 567 567 567	.8TD	经验验证据	397 398 398 397 397 289	- 305 - 305 - 393 - 398 - 398	993 269 263 297 305	-,273 -,269 -,265 -,268 -,290	- 45	-,800 -,911 -,808 -,159 -,197 -,809 -,857	-71 -78 -78 -78	- 011 - 101 - 107 - 109 - 100	1,000	33333	031	-,010	18438588	全部汽车运输	Ke Lange	当後記事を決定は	:25	1300 E 888 6 14	713 616	1.3年10分長年8分	1,070

						<u>' ' </u>	<u>,,</u>									_
				Oppor	per face						J.	-	1,00			
7/2	\mathbb{X}	17.40	14.50	29,40	9.54	7.3°	3.40	0.40	8	9,	L	<u>ዓ</u>	12.5	150	17.5	90°
0.025	abrasia 68	東京東京東京東	-0.095 -119 -189 -190 -201 -204	· · · · · · · · · · · · · · · · · · ·	-0.0% 0% 1% 1% 1% 1%	0.004 - 009 - 133 - 144 - 143 - 143	0.031 .031 .050 050 056	\$23EBB3\$	239888	37685888	81488883	8 4 434558	國家監督事務哲名	多數為客談案 直發	東京は東海道衛	\$85.4588
,250	\$\$35555	· · · · · · · · · · · · · · · · · · ·	美国的自由和智慧	きをといる。	25194588 251958	-,303 -,106 -,135 -,146 -,161 -,233	.020 .006 .056 .098 .098 .097	.067 .049 057 059 051 051	99989899	1738 8 8 8 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	11 145 050 050 050 050 050 050	多多数国际影响员	美长岩泉是多岩岩	はまるのでは	**************************************	* \$ 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5
.500	\$655.800000	9.美发表示形容点	当季贸易税机员 东	1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	· 经营业的	111111111111111111111111111111111111111	걆	885 6 6 8 6 A	.010 .013 .017 .050 .060 .060	P86888888	944888888 944888888	\$ 55 P. T. T. S. C.	500 663 611 181 181 181	36 30 30 30 30 30 30 30 30 30 30 30 30 30	子を開発用間報言	EN BERETS
סכד.	2000000	· 美 · 美 · 507 · 507 · 507 · 507 · 507	- 195 - 597 - 523 - 586	- 146 - 146 - 146 - 156 - 156	1000000	- 573 - 573 - 565 - 567 - 541 - 541 - 541	- 81	-,008 -,011 -,070 -,103 -,103	868973	8.8895	.196 .138 .105 .069 .007	.811 .831 .191 .161 .193	海	:32	を を を を を を を を を を を を を を を を を を を	.470 .477 .613 .648 .508
	_	 	1			T		T	T					-4-	T	110

(a) Wing 4; M-1.45; R-0.44×10° per buch

				0	b) Wing	14; M	1.07:	R=0,4	1×10 ⁸	per in	e ti					
	-			Upper	-							Lower	mer Face	•		
y/•	X	300	25°	\$Q ⁰	150	30	6°	3°	œ	30	8	100	159	*0°	250	300
-085	3938	· 多数数数数数数数数数数数数数数数数数数数数数数数数数数数数数数数数数数数数		4 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	0.00 .00 .11 .12 .13 .13 .13	386859778	E 600	3869688	0.050 0.050	8 <u>£639</u> 33	0 110 127 128 150 150 150 150 150 150 150 150 150 150	글리즈타카카리	別母を行る者は否	克曼克克勒斯 岛岛	元別が影響をはは	0.676 .738 .696 .733 .619 .613
.990	SPISSINE.	克斯尼斯斯斯斯	是是是其一	\$500 \$500 \$500 \$400 \$500 \$500 \$500 \$500	西野の大大の25	45 11 10 11 13 130 137 137	09969	000	,069 ,042 ,057 ,050 -,059 -,059	.051 .051 .050 .050 .050	\$338 BEES	\$1555555 51555 5155 5155 5155 5155 5155	東京養養電影司等	· 经有效的 (1) (1) (1) (1) (1) (1) (1) (1) (1) (1)	5555 E	万首级的 战争 沙漠
.500	BBJABBBB	********	為於實施的	इंड्र जन नंब क	- 954 - 953 - 953 - 953 - 953 - 957 - 957 - 957	- 270 - 271 - 160 - 160 - 165 - 166	- 808 - 157 - 608 - 128 - 128	19388EE	699699999999999999999999999999999999999	.150 .052 .052 .050 .057	154 154 154 155 155 155 155 155 155	\$500 A A A A A A A A A A A A A A A A A A	根目或母亲有有多	原理は無形的語句	阿索尼拉斯斯斯斯	ではいい
۰۲۶۰	.156 .350 .350 .500 .500 .500 .500	- 30 - 30 - 30 - 30 - 30 - 30	- 330 - 330 - 334 - 334 - 334 - 334 - 336 - 336	. 310 - 310 - 310 - 310 - 313 - 313	- 196 - 197 - 197 - 199 - 191 - 191	- 205 - 250 - 250 - 250 - 250 - 250	217 227 214 211 159	- 071 - 085 - 048 - 068 - 104	.058 .049 .013 .002 .014	.163 .198 .005 .013 .011	.150 .150 .100 .000	14公司の対象	をおおまなな	**************************************	京	· 6000000000000000000000000000000000000
.873	:26	853 854	- 270	873 867	-,663 -,27	20	-,ath	- 098		.076	:155	.415 .187	.318 198.	当	.50 .513	.630



TABLE I .- PRESSURE COEFFICIENTS OF WINGS - Concluded

(i) Wing 5: M-1	45 - P-C	144100	ner fach
(1) WILL 3: MEL	. 20: 10-		Delta Maria

Volume V	0.956	17.5°
0.025 0.054 -0.316 -0.299 -0.163 -0.066 0.041 0.140 0.170 0.227 0.451 0.688 0.8 1.41 -291 -296 -207 -127 0 1.04 1.36 261 1.34 .683 8 2.82 -331 -275 -2216 -1.48 -032 .070 1.02 229 369 .946 .6	A 0.956	
	4 0.956	1.157
.242331275216148032 .070 .102 .219 .369 .369 .546 .6	LI_cos≀	1/
		1.01 <u>2</u>
		1.83
6. [45] 6. [46		358
		308
7,973 -1,422 -1,500 -1,500 -1,500 -1,012 -1,012 -1,0	7	
.95 .623 .623 .623 .624 .204 .356 .623 .663 .9	3 1.042	1,114
77. [942] . 478. [325] . [341. [326] . [301. [302] . [315] . [315] . [315]	.801	
-, 242 -, 348 -, 262 -, 221 -, 148 -, 020 -, 077 -, 107 -, 268 -, 373 -, 302 -, 367 -, 368 -, 324 -, 262 -, 194 -, 067 -, 048 -, 158 -, 270 -, 367 -, 368 -, 324 -, 262 -, 194 -, 067 -, 018 -, 048 -, 158 -, 270 -, 365 -, 4	.653	
	3 -533 0 -124	603
		129
6. [253] .340393398298236339095031 .390336 .233 .395314 .369318 .293396090 .070 .005 .071 .161 .2		
.953422375322260173118101036 .022 .100 -1		278
.563 .054373271185095 .038 .172 .188 .330 .560 .818 .9 .141325258131118 .009 .121 .177 .295 .475 .644 .7		1.100
.141325258191118 .009 .121 .177 .295 .476 .644 .7	5 819	
- [.242]343[250]225 154 031 .072[.105] .234[.351 .460 .5	630	- 701
. 379 - 320		
.001301296297204171097080021112 .1		
.953300270238191154115104054005 .064 .1		
.875 .054329251170087 .050 .172 .208 .338 .475 .676 .7	891	.977
رّ. (794، إطلاق (203، إ11، 988، 900، إ10 (199 13 (198 14	6 660	
4. (346. (290. (191. (195. (395. (290. (111. (151. (195. (194. (194. (194. (194. (194. (194. (194. (.6 .500	.572
367 - 366186131097093008001240240240261		
2. 881. 170. 200. 260. 260. 460. 221. 271. 272. 262. 264. 264. 264. 265. 265. 265. 265. 265. 265. 265. 265		
	6) ,910 31 ,113	

(j) Wing 5; M=1.97; R=0.44x10⁴ per inch

				Upper	surfac	*						Lower	eurfa	>e		
y/s	36	30°	න	20°	15°	10°0	60	3°	oo	30	60	10°	15°	20°	25°	30°
0,085	0.054 .111 242 .617 .605	-0.289 -243 -266 -367	-0.256 -256 -257 -269 -282	0.208 202 202 202 202 202 202 202 202 202	-0.246 163 178 283	094	0.008 046 046 113 117	0.069 .006 .012 064	0.138 .092 .075 010	0.216 .168 .150 .056	0.301 .272 .234 .125 .119	0.33 50 32 32 33 33 33 34 34 34 34 34 34 34 34 34 34	0.640 -560 -568 -395	961	1.237	1.342 1.366 1.379 779 709
.270	\$2.50 \$2.50 \$3.50	\$ 50 00 00 00 00 00 00 00 00 00 00 00 00	10000000000000000000000000000000000000	- 188 - 915 - 924 - 237 - 253 - 263 - 241	196754 3 8 8 3 8 3 8 3 8 3 8 3 8 3 8 3 8 3 8	090 095 110 130 153 163 173 179	006 025 042 067 094 106 119	071	.126 .106 .080 .047 .019	.210 .189 .157 .118 .062 .064 .047	.300 .276 .247 .196 .157 .136 .117	44 98 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	.689 .645 .508 .504 .504 .504 .506	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1		1 2 3 3 5 6 7 7 7 5
.963	.034 .141 .242 .367 .637 .805 .903	- 308 - 267 - 269 - 295 - 296 - 266	-279 -276 -264 -276 -266 -367 -379	- 205 - 215 - 231 - 251 - 251 - 251 - 251 - 251	159 -125 -125 -125 -125 -125 -125 -125 -125	- 087 - 099 - 120 - 140 - 156 - 160 - 167	025 026 076 097 107 111 121	.047 .033 .003 023 045 056 072	.118 .101 .068 .037 .012 002	.180 .143 .108 .081 .063	.290 .265 .227 .186 .154 .129 .060	.136 .107 .378 .318 .265 .282 .166	.672 .627 .560 .460 .405 .205 .205	1.038 .692 .642 .544 .47	1,084	1.430 1.435 1.654 98.85 7.66 99.85 7.66 99.85 7.66 99.85
.8T3	.054 .141 .242 .367 .492 .617 .805 .903	280 272 270 944 266 269 295	238 237 233 211 240 276 277 287	205 208 801 175 197 215 237 253	155 162 153 149 163 184 198	080 094 088 094 098 098 116 133	004 023 033 047 067 064 075	.061 .099 .014 017 057 041 047	.132 .106 .068 .019 010 021	.185	.306 .266 .185 .118 .070 .055 .037	. 154 . 159 . 206 . 150 . 166 . 164 . 067	.682 .544 .295 .350 .347 .213 .213 .213 .213	93.763.54.353.35 3.763.43.353.35 3.763.353.35 3.763.353.35 3.763.353.353.35 3.763.353.353.35 3.763.353.353.35 3.763.353.353.353.35 3.763.353.353.35 3.763.353.353.35 3.763.353.35 3.763.353.35 3.763.35 3	1.180 .950 .792 .674 .573 .460 .408	1.179 1.179

TABLE II .- SPAN LOAD DISTRIBUTION, NORMAL FORCE, AND CENTER OF PRESSURE OF WING

		_	
(-) TIN	. 1 . 14-1 48	: R=0.44/40°	

					Q _R ,	sections	n Hace	ul-fa	TOR 80	ffici	met					j				3	/e, se	etilon	out Lar	of po	- CALIFORN	•					j	Intire	Ming	_
		Uppe	· — · · · · · · · · · · · · · · · · · ·								Boti	ant t	BC06			Uppe	T mari	100			Lon	e sued	808			Both	. surf	2001		~	9	2/a-	T _ē ,	
₹.	0,025	0.250	0.500	0.750	0.875	0.025	0.250	0.500	0.750	0.815	0.085	0.250	0.500	0.770	0.875	0.02	0.270	0.500	0.770	0.015	o.029	0.270	0.500	0.170	0.815	0.005	0,250	0.500	0.170	0.875	'''	"	~~	ľ
ឲ្យទីធ្វីទីទីស	0.036 .078 .186 .186 .237	108 195 303	169 130	£55.5	\$ (£ 15 15	.103 .190 .305	1831	117	,157 ,449 ,349 ,466	.105 272 .376	135.58	.918 .397 .617 .865	.896 .517 .855 .993	.129 .611 .197	.506 .653 .811 .968	有有	198	304 304	.463 .476 .478 .476	. (47)		5.5	.40	.467 .468 .498 .510	.176 .193 .508	5558	1881	10 mm	120	178	.079 .419		.656 .655	

(b) Wing 1; M-1.97; R-0.44×10⁴ per inch

L					- Ma	ments:	OIL DOT	m)fo	ros co	fflai	II.									X	/a, ===	tion o	m ter	of pre							,	htire	ATES	
		Upp	e per	Ros			Low	er par	(200)Ao ti	h mart	1.096			Upp	-	CALOR			Love	r med	Carge .			Bosh	ant t	LORE					<u> </u>
₹⁄• •	L025	0,270	0+500	0-750	0.875	0.025	0.250	0.500	0.150	0.575	0.087	0.250	0.500	0.150	0.815	0.025	0.250	0.500	0.170	0.875	0.025	0.250	d - 500	0.770	0.875	0.085	0.850	0.500	0.750	0.575	OM	C _B	첫/아-	<u>7/-</u>
88888888	095 095 198 159 205 207 207 207	E 5 5 6 6 5	计程序设置引入系统	.186	905 963 971 968 968 968 968 968	088 150 150 150 150 150 150 150 150 150 150	84488488888888888888888888888888888888	1999	23388888 23388888	5888 FEB.	151 305 505 1.136 1.136 1.136 1.136	100	.325 .393 .563 .699 .843 .990 1.139 1.337	320 467 596 723 639 1.009 1.272 1.406	· 200	445335336	主省的事员	全等多数的	955	\$5644965\$	1955555	458846555 6	452566555°	**************************************	**************************************	.100	. 449 084	\$515 SE	0.000 PER PROPERTY OF THE PROP	を を を を を を を を を を を を を を を を を を を	153 64 64 1.10 1.11	0	.661 .658 .658 .657	.50 .57 .52 .53 .53 .53 .53 .53 .53 .53 .53 .53 .53

(a) Wing 2: M=1.45: R=0.44x10* per inch

1											- шу	,	7,				- _											
				n, pe	etion :	orus.l	-105-04	17900	loient							≆/a, :	⇒∘t io	g gamet	er of ;	perosau	i.e				,	Earthlyre	ving	
	5	per s	urfiae		L	MET S	er fame		B4	oth ex	-Caosa			Opper .				Lover	ME (24	•	7	Both s	er face	4			=/.	E /.
×/•	0.025	0.250	0.500	0.150	0,025	0.250	0.700	0.750	0.025	0.870	0.500	0.770	0.025	0.270	0,500	0.770	0,025	0.270	0.500	0.750	0.025	0.470	0,500	0.790	C _M	G _a	₹/a _r	"*
865 50 84	0.019	.133 .891 .339		.978 .950		.147	.173 .985	.193 308	·維3 379 -29	-280	.966 614	.169 .696	. 464 - 572 - 469	.3 ⁰ 7	372	465666	.470	0.131 138 140 140	33888	\$2555g	. 467	.413	.407 .409	0.434 430 449	当	200,0 800, 110,	.651 .653 .647	.33 .92
50	.573 .573 .779	-729	530	.508	744 .870	25	.5\5 .700 .610	.699	1.075	1.236	1.230 1.340	1.201	l de	-130	建	15	.494	.471 .473	47	45	462 472	沒	.63	165 169	1,198 1,394	.036	.646	-33

(d) Wing S; M=1.97; B=0.44×10° per inst

ļ			og, m	46 1,00	-	l-fore	e peel	ficien	٠.)	•		ī/•, (meti a	n ment	⇒ of ;	b. eeur	r e				1	ntire	ATINE	
Ü	ller i	The Case		,	Loner (North Co.	•		loth .	. Lagran			jpper	per filos		1	-	ur fre	•	3	loth s	ur Face	•	-	٥.	ž/••	9
0.085	0.270	0.700	0.170	0.025	0.950	0.700	0.750	0.027	0.930	0.500	0.750	0,025	0.250	0.700	0.770	0.025	0.870	0.700	0.170	0.085	0.270	0.500	0.750		-	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	
.111 .125 .188	eeke Bries	355555555 35555555	.141 .903 .968 .303 .331 .332 .301	8 T 8 T 8 T 9	当者 第本の子の を	.139 .568 .506 .506	A 有 多 多 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	1986	. 161 . 548 . 724 . 907 1.068	.531 .601 .508 .978 1.105 1.235	1.06 1.06 1.06 1.09	が強い。	17 B 13 B 14 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	东京各位商品	金属高高高	8585855 858585	多多年至年	156	がのないが	32.5	-130 -149 -146 -157	146	383858	.56 28 28	.010 .017 .099 .035	444	

TABLE II .- SPAN LOAD DISTRIBUTION, NORMAL FORCE, AND CENTER OF PRESSURE OF WING - Continued

(e) Wing 3; M=1.45; R=0.44×10 ⁶ per i
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				c ₀ , #	ortdon 1	ormal.	fores	coeff	loient							1/a, i	ectio	0000	er of p	reser	re				1	latire	wing	
	0	pper e	er face		L	OFFEE M	u, face			Both s	r/ace	•		pper .	ner faci		1	OF-E	urface	•	1	loth m	#14ce	-	Cur		₹/o _₽	ÿ/s
Ä	0.025	0.270	0.563	0.015	0.027	0.250	0.763	و.8 ₁	0.025	0.250	0.563	0.877	3.02 5	0.250	0.763	0.875	0.025	0.250	0.563	0.877	0.025	0.250	0.563	0.875		•	7.4	"
ರ್ಷಕ್ರಿಯ	0.091 181 .386	0.001 167 269	.116	0.016 .096 .173	0.098 .208 .338	6.5 2.5 2.5 3.5 3.5 3.5 3.5 3.5 3.5 3.5 3.5 3.5 3	0.088 .191 .306	197	0.189	0.191 .380 .605			146		.397 .503	379		0.113 .370 .332	5388	0.53 337 349	.430		•377	:認	امتحا		.390 .396	+33

(f) Wing 3; M-1.97; R-0.44x10⁶ per inch.

1				съ, н	etia	perme)	-fore	noest:	intent							1/e,	eotia	ounts	er of 1	T-100					<u> </u>	betire	wing	
]		Opper e	120		1	LOWER I	m Du		1	loth at	Trisce.		1	урег	murfac	•	i	(100)	er fao	. 1	1	oth s	urface	•	C _m		.,	2/-
又	0.025	0.970	0.763	0.875	0.025	5.250	0.969	0.875	0.025	0.250	0.563	0.875	0.025	0.250	0.563	0.875	0.025	0.250	0.563	0.875	0.025	0.250	0.763	0.875	•	- Ga	#/o _p	§/s
3° 6° 15° 25° 25° 25°	0.019 .101 .159 .217 .263 .898 .515	.105 .161 .825 .923 .934	.156 .211 .219 .278	.070 .116 .177	132 247 426 634 831 969	.150 .850 .417 .591 .743	134 189 190 197 197 197	.093 .178 .170 .170 .170	.643 .698 1.109 1.884	813 631 631 1 027 1 198	.937 .100 .612 .821 .992	.163 .493 .490 .694 .875	が数の場合は	449 446 447 448	,443 ,443 ,447 ,444 ,440	372 108 137 157 157	40.45	**************************************	新兵员第 第5	376 394 419 419 419 419	SES 535	.446 .447 .427 .429	148 143 138 123	.374 .400 .421 .429 .430	.365 .570	.013 .021 .034 .054 .067	.437 .440 .430 .430 .438	.456 .456 .456 .460
٥	330 333	-323	.308	-310	L_205	1.182	1.125	1.000	1.535	1.705	1.443	1.317	431	•437	1.436	.443 .446	1405	-447	. 455	177	.473	.445	認	, 444	1.51	.063	. kga.	.46

(g) Wing 4; M=1.45; R=0.44×10° per inch.

ا بهه	section normal-force coeffici	ent		%/o, section center of pressure		Matire	wing
Depar seriace	Lower surface	Both surfaces	Opper surface	Lower surface	Both surfaces		=/ =/
7/4 0.023 0.250 0.500 0.750 0.875	0.025 0.250 0.500 0.750 0.57	0.025 0.250 0.500 0.750 0.875	0.025 0.250 0.500 0.750 0.87	0.025 0.250 0.500 0.750 0.875 0.025	0.250 0.500 0.750 0.875	Car Ca	x/cz 7/≥
0 0.039 0.072 0.086 0.349 0.160 0 176 180 1.87 880 273 1.30 1.69 341 955 340 1.57 269 250 486 373 0 1.16 336 504 445 391	0.047 0.048 0.060 0.084 0.10 .099 .108 .128 .177 .18 .178 .188 .206 .247 .80 .447 .256 .272 .308 .34	· 306 · 307 · 307 · 407 · 408	1 A74 360 460 A60 .70	486 479 480 493 496 481 482 479 487 500 499 471	457 -400 -455 -587 466 -443 -478 -511	.463 .008 .589003	.664 .39

(h) Wing 4; M-1.97; R-0.44×10° per inch

	ĺ					0,0	, ,,,,,,	rt1on	100	al-fo	00 00	dfie	e nt									3	t/a, m	ection	ees tes	of p	Object:	•					l	Antibre	ving	-
	Г		Üpp	C. S.T.	Гвос		T		Loui		Mar		T	Boti	merf	1048		T-	Upp	- AUG	1 100			Low	of 1865	Non			But	a surf	8688	\Box	C.	C.	7/2	9/
all	0.0	025 (.250	0.500	0.7	0 0.87	70.0	DE 7 0	870	0.500	0.770	0.07	0.025	0.270	0.500	0.770	0.815	0.02	0.250	0.500	0.770	0.879	0.005	0-870	0.500	0-750	0.07)	0.085	0.270	0.500	0-750	0.875		"	₹/ᢏ	l "
5.05.05.05.05.05.05.05.05.05.05.05.05.05		054 096	.040 .077 .146 .288 .277 .519	748 7	.29 .29	1 .25 2 .26 7 .27 1 .26	4 .0	150 150 157 177 206	\$ 65 K 10 K 1	.106 .180 .#86	.123 200 301	.15 .81 .31 .42	.248 .369	.169 .311 .459 .667	.995 .569 .714	. 135 . 192 . 608 . 121 . 636	.506 .506 .501 .697	. 191 . 185 . 185	.447 .379 .384 .450	35.67.55	374 375 375 375 375 375 375 375 375 375 375	- 地名	189 189 190 196	653.5	- 76	. 1/2 . 1/9 . 1/98	.00 20 20	190 190 190	196	130 130 157 178	.168 .176	\$5.55 B	-206 -311 -500	.005 .005 .005	.660 .662 .699	

TABLE II .- SPAN LOAD DISTRIBUTION, NORMAL FORCE, AND CENTER OF PRESSURE OF WING - Concluded

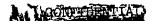
(i) Wing 5; M=1.45; R=0.44×10⁶ per inch

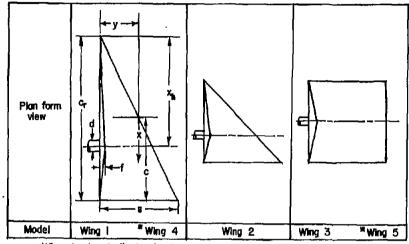
	İ		c	n, 580	tion r	ormel.	force	coeff	alent							⊼/c, ∎	ec 110	oente	rofj	леван	·e				1	intire	wing	
	Ē	lpper i	norface		7	OHAL I	urface	•	1	oth su	rface	,	Ü3	ger a	rface		L	OWNERS BET	rface		В	oth em	rfaces				2/-	Γ.,
V	0.025	0.250	0.563	0.875	0.025	0.250	0.563	0.875	0.025	0.250	0.563	0.875	0.025	0.250	0.563	0.875	0.025	0.250	0.563	0.875	0.025	0.250	0.568	0.875	C≡	C _m	¥/or	y/=
36° 02.5° 02	0.095 .160 .284 .343 .399		.118 .242 .300	.100 .179 .237 .291	199 330 413	.215 .338 .111	.389 .380 .380	.121 .217 .281 .347	379 614 776	.387 .619 .753 .874	-337 -550 -680 -797	.221 .396 .520 .637	.473 .473 .474	.456 .456 .454	398 - 101 - 111	366 424 442 450	.408 .401 .403	.389 .396	374 380 390 400		.437 .434 .433	413 423 428 432	.385 .391 .399	.351 .383	.316 .20 .646 .766	.033 .049	396 105	. A.

(i) Wing 5; M=1.97; R=0.44×10° per inch

			,	n, sec	tion :	normal	-force	coeff	icient						- · ·	ã∕o,	section	n cent	er of	ргевы	uro					L ot:	re vit	4g
	ū	pper i	urface	•	1	Lower	mrfac	•]	Both #	rfaces	3	1	Ipper s	urfac	-	1	CVOT I	orface	=	B	oth s	urface			_		
V	0.025	0.250	0.563	0.675	0.025	0.250	0.563	0.875	0.025	0.250	0.563	و815ء	0.025	0,250	0.563	0.875	0.025	0.250	0.563	0.875	0.025	0.250	0.563	0.877	CNI	Cm	ī/c _r	₹/•
	0.060 .115 .178 .240 .283 .317 .328	.113 .174 .232 .269	.108 .167 .225 .264	.073 .123 .186 .235 .272	274 274 456 653	.148 .266 .441 .625	135 246 405 583 736	.096 .184 .318 .478	.264 .472 .696 .936	.961 .440 .673 .894 1.078	.243 .413	.169 .307 .504 .713 .911	.478 .477 .474 .471 .469	.471 .463 .464	446 448 449 492	377 - 133 - 142	478 479 469 444 438	446 440 453 433 435	457 447 440 426 428	38 415 429	478 478 471 429 447	0.459 .457 .450 .457 .441 .443	451 447 443 434	.301 .107 .125	.386 .599	.080	147 148 148 148 148 148 148 148 148 148 148	45 45 45







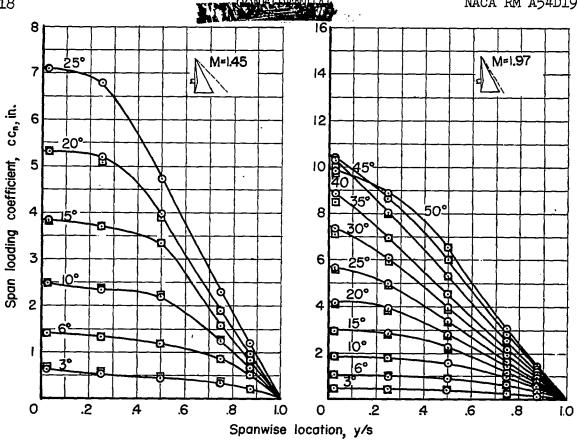
*Wings having duplicate plan forms but mounted on turntable and without thickened root section

A	2	4	2
C _r In	8	4	4
s in	4	4	4
Xh/Gr	.667	,667	.500
S in ²	16	8	16
d in	.875	.625	.625
f in	,250	,350	,400

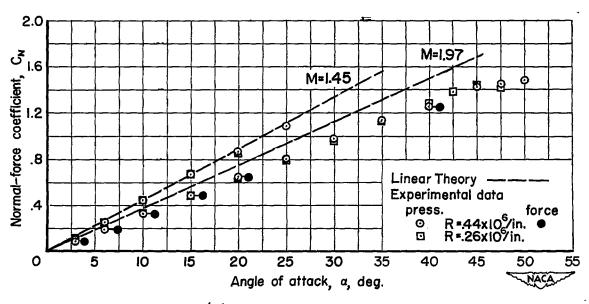
<u> </u>	4	_	•				<u>c —</u>				
x/c	0.00	.Ю0	.200	.300	,400	,500	.600	700	.800	.900	1000
t/c	000	.018	.032	.042	.048	.050	.049	.046	,041	,034	,025

	Root chard fillet ordinate t/c,			Typical root chord fillet fairing
x/C _T	Wing I	Wing 2	Wing 3	
0.00	0.000	0.000	0.000	
.10	.025	.038	.046	Tig rod
,20	.048	.072	,085	
.30	1068	.102	.119	
.40	.085	,126	.143	
.50	.099	,144	.156	
.60	107	.155	.145	ď
.70	.106	.152	.124	Rear view
.80	.086	.122	.097	
,90	.059	.081	.063	
1.00	.025	.025	.025	

Figure 1.- Wing dimensions and identity.



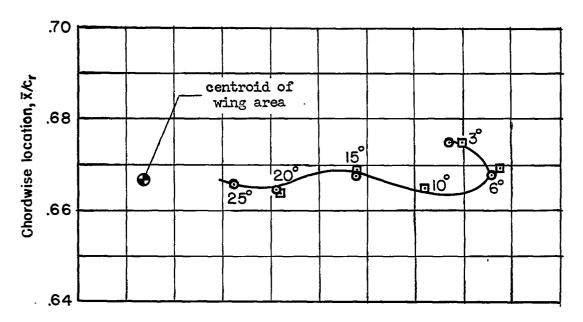
(a) Span loading.



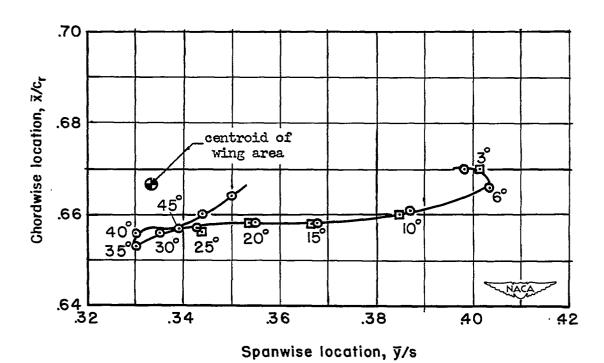
(b) Normal-force curves.

Figure 2.- Aerodynamic characteristics of wing 1.





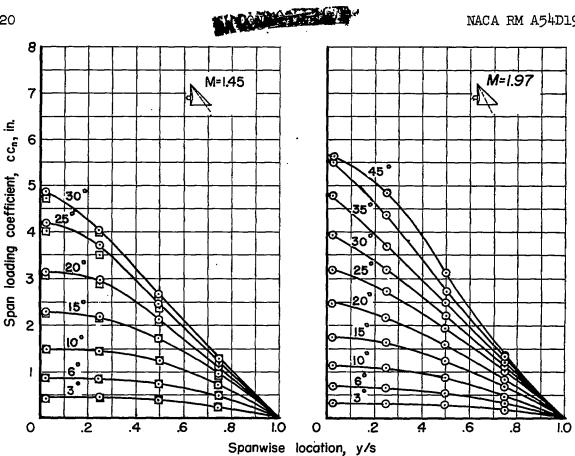
(c) Center-of-pressure position; M = 1.45.

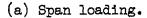


(d) Center-of-pressure position; M = 1.97.

Figure 2.- Concluded.







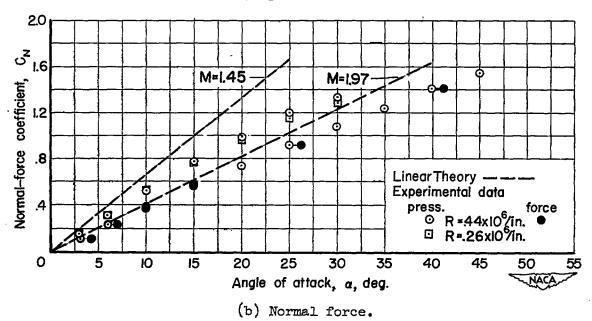
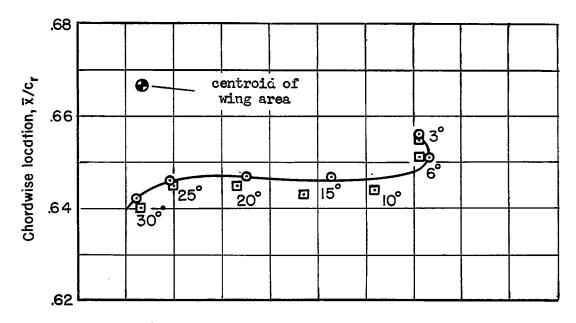
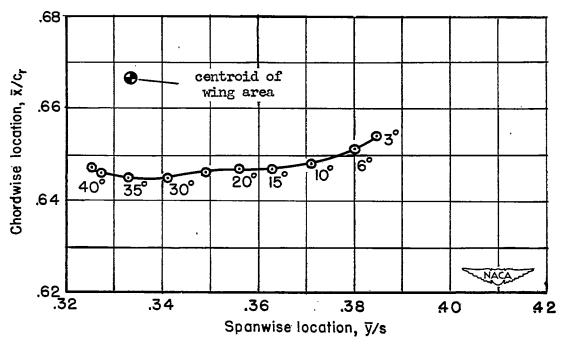


Figure 3.- Aerodynamic characteristics of wing 2.



(c) Center-of-pressure position; M = 1.45.

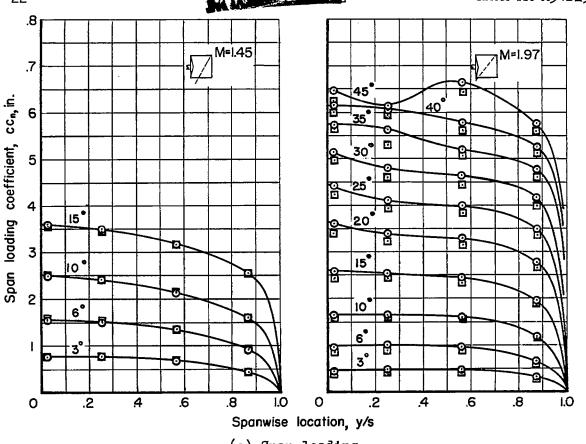


(d) Center-of-pressure position; M = 1.97.

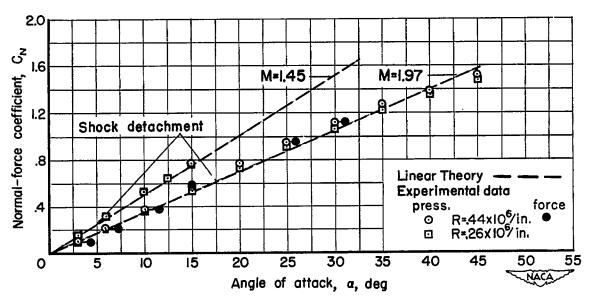
Figure 3.- Concluded.







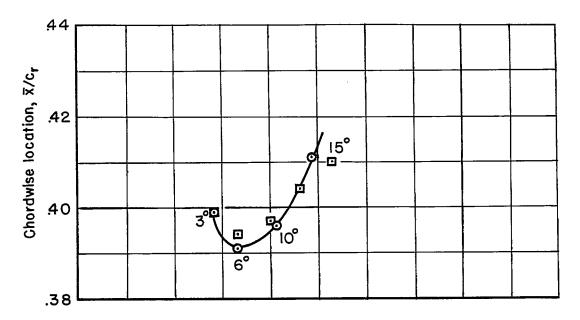
(a) Span loading.



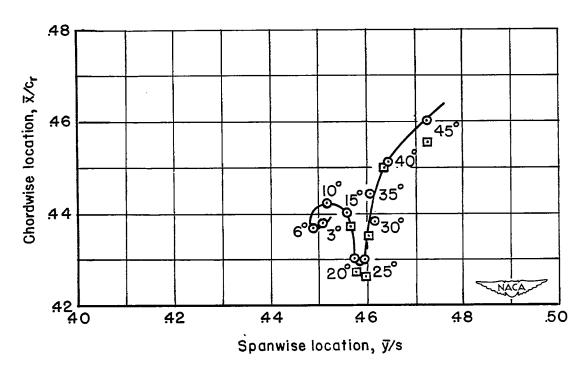
(b) Normal-force curves.

Figure 4.- Aerodynamic characteristics of wing 3.

Ac local and the



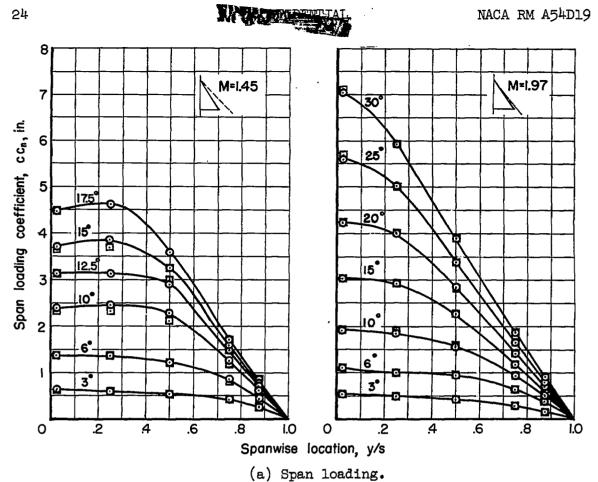
(c) Center-of-pressure position; M = 1.45.



(d) Center-of-pressure position; M = 1.97.

Figure 4.- Concluded.





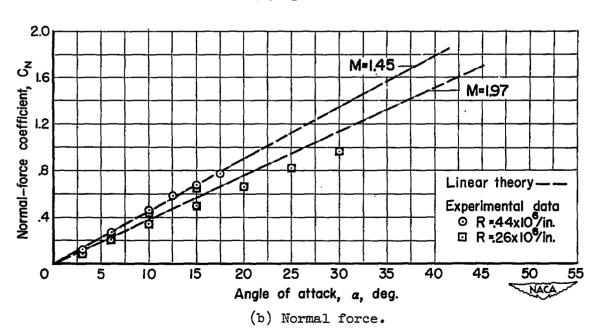
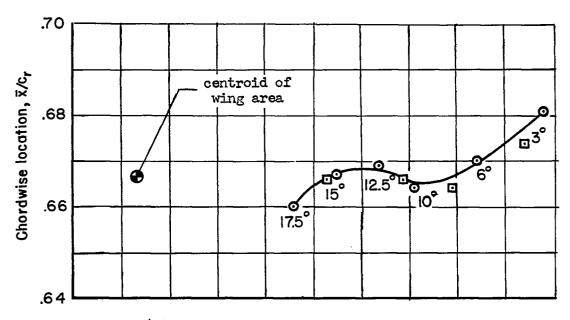


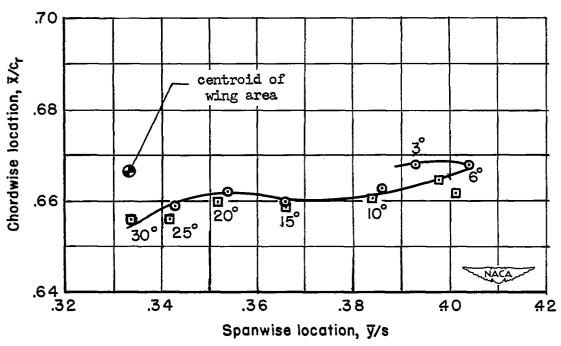
Figure 5.- Aerodynamic characteristics of wing 4.







(c) Center-of-pressure position; M = 1.45.

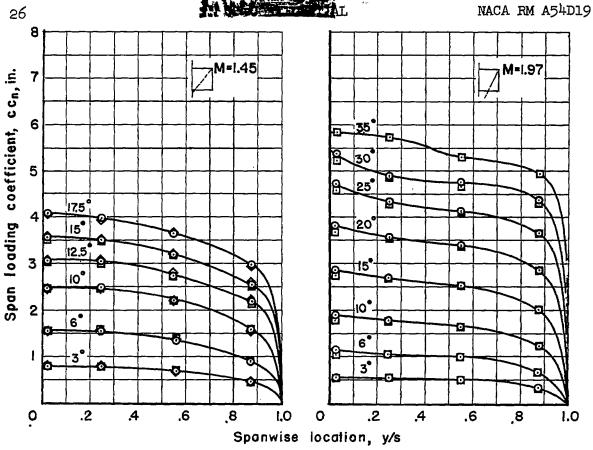


(d) Center-of-pressure position; M = 1.97.

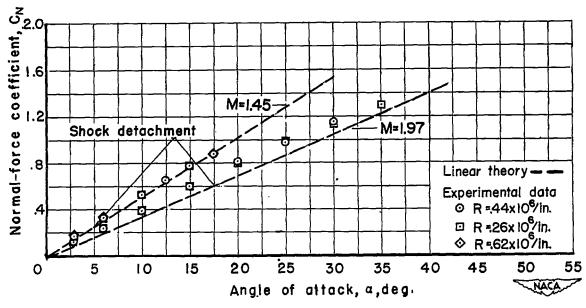
Figure 5.- Concluded.





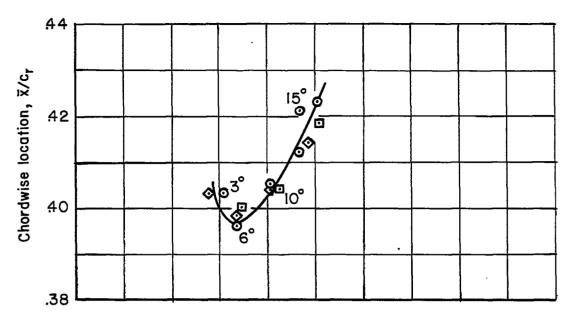


(a) Span loading.

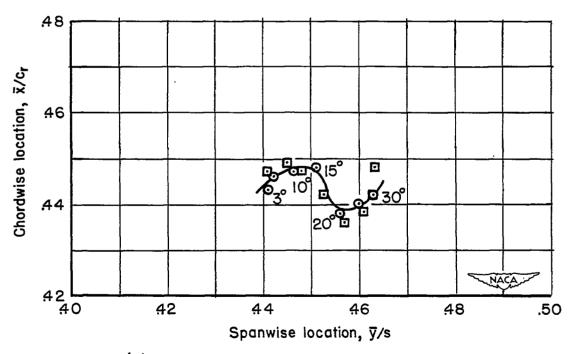


(b) Normal-force curves.

Figure 6.- Aerodynamic characteristics of wing 5.



(c) Center-of-pressure position; M = 1.45.



(d) Center-of-pressure position; M = 1.97.

Figure 6.- Concluded.

